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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/539,260	06/15/2005	Jan Haisma	NL02 1443 US1	7528

65913 7590 02/19/2010

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ART UNIT	PAPER NUMBER
1794	

NOTIFICATION DATE	DELIVERY MODE
02/19/2010	ELECTRONIC

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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/539,260
Filing Date: June 15, 2005
Appellant(s): HAISMA, JAN

Robert J. Crawford
Registration No. 32,122
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed January 11, 2010 appealing from the Office action mailed September 3, 2009.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

6,417,075	Haberger et al.	07-2002

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-10 and 21-28 are rejected under 35 U.S.C. 102(b) as being anticipated by Haberger et al. (WO9967820), published December 29, 1999, whose US counterpart (US 6,417,075), is referenced as the English translation.

In regards to claims 1-5, Haberger et al. teach an SOI wafer comprising a first substrate and a second substrate bonded to each other by their faces via one or several intermediate bonding layers. At least one of the bonding layers is configured that it presents recesses (col. 3, lines 62-66). The two substrates are preferably

semiconductor substrates (col. 4, lines 5), and specifically mention the substrates to be silicon (see the entire specification). As seen in Figure 3, in the first picture of the cross section views of group 5, the substrate exhibits pillars that extend from the substrate. Haberger teaches "Where the structures may be performed also as far as into the substrate as such" (col. 7, lines 45-50). Haberger teaches rounded corners (col. 4, lines 40-53 or col. 7, lines 35-40). These rounded corners naturally occur during forming the structures through wet etching. The trenches are formed of the same material and by the same process as instantly claimed (selective patterning with photolithography and then wet or dry etching), and therefore are expected to have the same structural features as instantly claimed.

Two silicon wafers will have dilatation behaviors that are substantially the same, since they are the same material. The bonding layers are taught to be SiO_2 in preferred embodiments (col. 5, lines 1-8). A SiO_2 layer has a dilatation mismatch with the first layer (silicon). The patterned trenches are structures that expectantly and inherently absorb stress originating from the dilatation mismatch.

Since Haberger teaches the same structure as instantly claimed, it is expected to behave in the same manner as instantly claimed. It has been held that where the claimed and prior art products are identical or substantially identical in structure or are produced by identical or a substantially identical processes, a prima facie case of either anticipation or obviousness will be considered to have been established over functional limitations that stem from the claimed structure. ***In re Best***, 195 USPQ 430, 433 (CCPA 1977), *In re Spada,* 15 USPQ2d 1655, 1658 (Fed. Cir. 1990). The ***prima facie*** case

can be rebutted by evidence showing that the prior art products do not necessarily posses the characteristics of the claimed products. *In re Best*, 195 USPQ 430, 433 (CCPA 1977).

Even though Haberger teaches a subsequent step of introducing etchants in between the two silicon layers through the recesses in order to separate the structures. The intermediate layer as formed will read on the applicants structure as instantly claimed, and still qualifies as prior art.

Regarding claim 6, SiO_2 is electrically insulating.

Regarding claim 7, Haberger et al. teaches that the width of the trenches and height of the trenches is less than one centimeter (col. 6, lines 61-64).

Regarding claim 8, the channels have a linear orientation perpendicular to a plane of the carrier (col. 4, lines 38-39, and figures 2).

Regarding claim 9, the channels are rectangular in shape and extend across the wafer (figure 2), therefore, the structures are parallel to a plane of the carrier. Furthermore, Haberger et al. describe that the structures need not present a rectangular cross section, or across linear orientations (col. 4, lines 38-43), Haberger teaches the shapes of the channels may be rounded, rectangular or polygonal (col. 7, lines 35-40).

Regarding claim 10, the composite substrate is an SOI wafer.

Regarding claims 21 and 23, the layers are all bonded to each other (col. 3, lines 60-65).

Regarding claim 22, the wafers of Haberger et al are silicon (semiconductor material) and the intermediate layer is silicon oxide (oxide of the semiconductor material) (see at least (col. 5, lines 1-5, and col. 2, lines 25-35).

Regarding claims 24, Haberger teaches an oxide layer present atop a silicon wafer but is silent to the means of achieving this layer, specifically thermally oxidizing the surface of the semiconductor wafer. However, Haberger teaches the same materials and the same structure, and therefor, the process limitations are given little patentable weight. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process.", (In re Thorpe, 227 USPQ 964,966). Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product (In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983), MPEP 2113).

Regarding claims 25 and 26, the structure of Haberger is the same as instantly claimed, and Haberger teaches placing the structures at selected locations of the intermediate layer (see the figures). For these reasons it is the examiner's position that since Haberger teaches the same materials, the same structures, and the same

spacing, that they will inherently and expectedly possess the same characteristics of stress relief as instantly claimed, and removing dislocations as instantly claimed. Stress is expected to occur between the mismatched layers, and since Haberger teaches the same structures as instantly claimed and the same position of the intermediate layer as instantly claimed, the structures of Haberger are said to be located at least where there is some degree of stress originating from the dilatation mismatch. See in re best applied above.

Regarding claim 27, Haberger teaches that the structures may be in the form of islets (col. 7, lines 49-60) and may have a round structure (col. 7, lines 35-40). The widths of the structures are taught to be 0.1 microns to 2 microns (col. 4, lines 10) thereby showing a diameter in the range instantly claimed.

Regarding claim 28, Haberger teaches a device layer formed on the thinned semiconductor (col. 6, lines 25-30) and col. 5 lines 30-35), which is performed before the separation of the structure.

****Additional support for the Examiner's rejection with regard to the instant limitation of "the pillar extensions having rounded corners that meet the surface of the carrier, the rounded corners forming a gradual interface between the sidewalls of the pillar extensions and the surface of the carrier" is found in Haberger in col. 7, lines 36-48, and argued starting on page 7 of the Final office action mailed September 3, 2009.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 9 and 27 are rejected under 35 U.S.C. 103(a) as being anticipated by Haberger et al. (WO9967820), published December 29, 1999, whose US counterpart (US 6,417,075), is referenced as the English translation, as applied above.

Haberger et al. teach a SOI substrate comprising two semiconductor wafers separated by a patterned oxide insulating layer of silicon dioxide, as described above. Haberger et al. teach shapes and sizes as seen in figures 2 and 3, and mentioned above, in which rounded structures in an islet form are mentioned. Haberger also teaches that the widths of the structures are between 0.1 and 2 microns. Haberger does not mention the exact sizes and shapes as instantly claimed, however It would have been obvious to a person having ordinary skill in the art at the time the present invention was made, and well within their grasp, to choose any desired pattern including those shapes and sizes instantly claimed, as these are shown to be desired effective results. It would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the shapes and sizes of patterns in the insulating layer for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

(10) Response to Argument

A. 1. The 102(b) rejection of claims 1-10 and 21-28 is improper because the Examiner has misinterpreted the teachings of the '075 reference.

On page 4 of the appeal brief filed January 11, 2010, appellant argues that "the Examiner improperly relies upon Col. 7:35-40 of the '075 reference which does not concern the interface between the sidewalls of channels 5 and the surface of the substrate, but instead teaches that the shape and structure of the lateral extensions of the channels can be rectangular, round meandering, or polygon type. See, e.g., Col. 7,:28-40. As such Col. 7:35-40 of the '075 reference does not provide any support for the Examiner's position that the '075 reference teaches rounded corners forming a gradual interface as in the claimed invention".

The appellant also argue that "The Examiner apparently confuses the unrelated teachings of the '075 reference directed to the different cross sectional shapes of the channels 5 (as shown by the four example cross sections at the bottom of Figure 3) with the example shapes of the lateral extensions of the channels 5".

The examiner disagrees. The teachings of Haberger as seen in col. 7, lines 28-48 is directed to the shapes of the **channels (5)**.

On line 28 of col. 7, Haberger teaches "the geometric configuration of the **channels (5)**, specifically the shape of their lateral extension" is entirely free of the formation of bonding islets. As must be understood from the Haberger reference, the lateral extensions refer to a lateral plane viewed from the side of the wafer (so as to be

looking at the cross section of the extensions of the channels). The Examiners position is supported in col. 3, lines 63-67 and col. 5, lines 43-48 of Haberger, which show that the lateral accessibility of the channels is sealed (at the edges) to form a hermetic seal, thus when the applicant references "the geometric configuration of the channels 5, specifically the shape of the lateral extension", they are referencing the cross sectional shapes of the channels. Never does Haberger mention the geometric shapes of the channels, specifically the shape of their lateral extension, to be a top planar (birds eye) view of the intermediate layer within this above mentioned passage, as is contested by the appellant. The reference to the "shapes of the lateral extensions" (col. 7, line 29) is in reference to the "geometric configuration of the **channels (5)**" (col. 7, lines 28-29).

In the paragraph starting at line 36 of col. 7, Haberger is referencing the "Exemplary shapes of the **channels (5)** in both substrates are rectangular, round, meandering, or polygon type". A blown up view of the **channels 5** is seen in the four bottom figures of Figure 3, which shows two of these exemplary shapes of channels (rectangular and polygon type), is provided by Haberger as "Examples of different cross sectional shapes of the **channels (5)** are illustrated in Fig. 3,". This entire excerpt is in relationship to the shapes of the **channels 5** and is not in reference to the top planar (bird's eye) view of the substrate as the appellant contends.

The top planar (birds eye) view of the intermediate layer, which the appellant contends to be the "lateral extensions" is actually referenced by Haberger in col. 7, lines 49-58. Haberger teaches that "the bonding layer may be structured in the form if islets, or in strip or puncti form shape, Fig. 3 illustrates an islet type structuring in the form of a

lattice structure". The bird's eye view of Figure 2 shows an intermediate layer in the form of "strips" whereas the bird's eye view of Figure 3 shows an intermediate layer of "islet type structuring in the form of a lattice structure".

On page 5 of the appeal brief, appellant contends that "It is unclear how the cross sectional shapes for the channels 5 could be meandering or even round". The Examiner contends that the cross sectional shapes of the instant invention are circular (see instant claim 9). So it appears, at least from the claim language, that appellant has cross sectional shapes that are round which is consistent with what is taught by Haberger.

For these reasons the rejections are maintained.

2. The 102 (b) rejection of claims 1-10 and 21-28 is improper because the asserted correspondence is improperly based upon an inherent feature not present in the '075 reference.

On page 6 of the Appeal brief, the appellant contests that "there is no indication in the cited reference, nor in the appellant's specification, that selectively patterning with photolithography and then wet or dry etching must result in rounded corners as asserted by the Examiner".

The Examiner disagrees. The Examiner contends that wet etching will result in some degree of rounded corners. The appellant is not claiming a specific degree of rounding, nor does the claim specify a radius of curvature. Since Haberger teaches similar techniques to those instantly taught (i.e. photolithography patterned masks

followed by reactive ion etching or wet etching (page 8, lines 24 of the instant specification) and further that those techniques are recognized in the art to result in rounded corners (claim 1 of US 2001/0023960), it is the Examiners position that the techniques taught by Haberger will necessarily result in rounded corners at the bottom of the trenches, no matter how small or miniscule that degree of rounding may be.

3. The 102 (b) rejection of claim 24 is improper because the '075 reference lacks correspondence.

On page 6 of the appeal brief, appellant asserts that "the Examiner erroneously bases the rejection of claim 24 on product by process case law when no product by process limitations are present in claim 24". The Examiner disagrees. The limitation of "thermally oxidized" is considered a product by process limitation. Wherein "thermally" imparts a process limitation of heating a substrate to oxidize the surface.

On page 7 of the appeal brief, the appellant asserts that by equating the specific material with a product by process step, the office action has improperly ignored these aspects of claim 24, which are not taught by the Haberger reference. Specifically, thermal oxidation results in a thin layer of oxidation only a few atomic layers thick on the surface of the semiconductor material. Conversely the oxidation layer in the Haberger reference is roughly 1 micron thick.

The Examiner disagrees for several reasons. The material structure instantly claimed is an oxidized semiconductor material, Haberger teaches a semiconductor oxide material, and therefore has the same structure as instantly claimed. The appellant

has not shown a structural difference between the semiconductor oxide layer of Haberger and the instantly claimed semiconductor oxide material instantly claimed, and therefore the rejections are maintained.

Furthermore, appellant appears to be asserting that their intermediate pillar extensions are only a few atomic layers thick. The Examiner would disagree with this statement. A "native oxide" on semiconductors is known to have a thickness of a few atomic layers, not a "thermally grown oxide". Thermally grown oxides are known in the art to have much larger thicknesses, usually on the angstrom, nanometer, and micron scale. Finally the appellant is not claiming a thickness in claim 24, and the thickness of a thermally grown oxide layer is not limited in the art or defined within the instant specification to be a few atomic layers thick, therefore the appellant's arguments are not commensurate with the scope of the claims.

2. The 103(a) rejection of claims 9 and 27 is improper because the Examiner relies on an improper obvious to try argument.

It is the Examiners position that although the Haberger reference does not mention the exact sizes and shapes as instantly claimed it would have been obvious to choose any desired pattern including those shapes and sizes instantly claimed, as these are shown to be desired effective results.

On page 8 of the appeal brief, appellant argues that the Examiner has failed to show any indication in the Haberger reference of a goal towards which one of ordinary

skill in the art would work before ceasing experimentation, in order to reach the desired effective results or optimum results.

Support for the "endeavor" as requested by the appellant is found in col.'s 7 and 8 of Haberger. Haberger teaches that cross sectional shapes should duly consider the marginal conditions "bonding force" and wafer or substrate bending, which are necessary for stable bonding and ensure at the same time an efficient transfer of the etching agent (col. 7, lines 32-25). Haberger also teaches that the islet shaped structure (bird's eye view of the bonding layer) presents the advantage, in addition to the better distribution of etching liquid, that mechanical strain will be avoided in the wafer Col. 7, lines 53-55). Haberger finally teaches that the reduced bonding area (due the structure of islands) results in a lower bonding force; however this is sufficient to resist the thermal strain occurring during thermal processing. Haberger teaches that a pitch (channel width of 1 micron does not result in troublesome local or global bending 9col. 8, lines 15-26). Finally, Haberger teaches line widths of 1-2 microns (col. 6, lines 60-65).

Haberger teaches a bird's eye view of the bonding layer which comprises islands as seen in figure 3. This structure comprises "streets" and "alleys" of channels that alloy the infiltration of etching materials. It is the examiner's position that choosing a circular shape, when viewed from a bird's eye view, for the bonding layer islands would have been obvious to a routineer in the art, as this would allow better infiltration of the etching liquids during device separation. Choosing a size of 1-2 microns for the diameter would have been obvious as these have been shown to be known and workable ranges taught

by Haberger. It is the Examiners position that optimizing the shape and the size of the islands would have been well within the grasp of a routineer in the art in order to ensure sufficient bonding strength, as well as to ensure that no troublesome bending occurs (i.e. maintaining mechanical stability), and finally while allowing the efficient transfer of the etching agent. All of these attributes being recognized by Haberger as known conditions used to achieve known and recognized desired effective results.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

JCL

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